MASS SPECTROMETRIC STUDY OF SULFUR VAPOR

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It is well known that sulfur catenates and forms oligmers ranging from S2 to S20. The actual number of species present in the vapor depends on several factors and has been the subject of many studies (e.g.: ref. 1). The main problem associated with the mass spectrometric studies is the tendency of the sulfur vapor to depolymerize or break up into smaller units under the ion source conditions. Therefore, one has to employ lower electron impact energies to identify the true abundances of various specks present in the sulfur vapor and the pathways of dissociation.

Mass spectrometric properties of sulfur vapor are important for modeling several planetary atmospheres, for monitoring atmospheric pollution near the sources of sulfur, and for understanding the process of oligmerization. This prompted us to undertake a systematic study of sulfur vapor . A schematic diagram of the apparatus used for this purpose is shown in fig. 1. Chemically pure sulfur was heated in a crucible. The temperature of the crucible was monitored by a thermocouple gauge. Molecular beam of sulfur formed this way was crossed at 900 by an energy selected beam of electrons. The ions generated as a result of electron impact were extracted by a pair of molybdenum wire meshes which directed them to a time-of-flight mass spectrometer placed at right angles to both electron beam and molecular beam. Details on the methods of ion detection and data acquisition are given in our previous publication

The following studies were carried out: 1) acquisition of mass spectra of sulfur vapor as a function of temperature of the crucible and electron impact energy, 2) measurement of threshold energies for various ionic species, and 3) measurement of normalized values of cross sections for the formation Of S_8^+ by electron impact on S_8 in the energy range of threshold to 1000 eV.

Figure 2 shows a typical mass spectrum of the sulfur vapor which emanated from the crucible at room temperature into the vacuum chamber at about 1.2x10-7 Torr. Data on thresholds and cross sections will be presented at the time of the meeting.

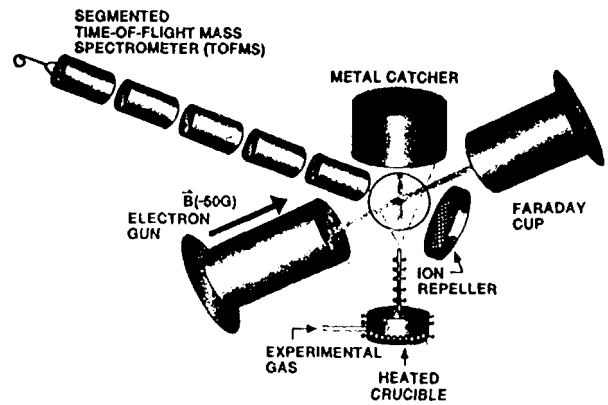

Fig. 1. Schematic diagram of the experimental arrangement.

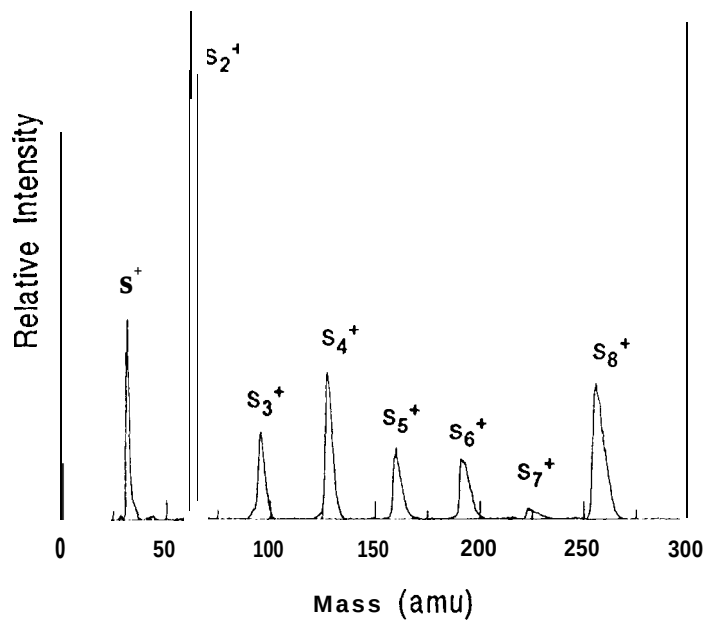

Fig. 2. Mass spectrum of sulfur vapor at 70 CV electron impact energy.

Reference

1. G. Dudck and E. P. Dudck, J. Chem. Edu. 66,304 (1989).

2. E. Krishnakumar and S. K. Srivastava, J. Phys. b: At. Mol. Opt. Phys. 21,1055 (1988).